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SURVIVING GENERATIVE AI: TEMPORAL TRAJECTORY OF RESILIENCE IN STACK OVERFLOW AND GITHUB

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Platforms such as Stack Overflow and GitHub serve as the lifeblood for global knowledge exchange for software development, yet they face profound challenges from emerging technologies like Generative AI (GAI) that accelerate knowledge creation (Chen et al., 2024) and effectively mimics humans – creating challenges ensuing human-governed, open-knowledge IS systems. These crowd-driven environments operate with a distinctive blend of openness and decentralised user governance, making them especially vulnerable when their established governance structures are disrupted. In open-knowledge platforms, the unpredictable nature of the crowd, and its importance in setting the trajectory as disruptions occur, complicates the organisation’s capacity to absorb shocks, adapt, and transform in response (Zamani et al., 2022). Understanding the temporal dynamics of these responses is crucial, as resilience is not a static state, but an evolving process shaped by how crowds engage with change over time (Hernes et al., 2025).

Through the cases of Stack Overflow and GitHub, we investigate the crowd’s temporal trajectory for resilience, and how this can lead to markedly different outcomes. Crowds in these platforms are the governing body, influencing key decisions, setting regulations, mobilising around common interests, and in these cases core to the setting of the trajectory after disruptions occur. While the crowd in Stack Overflow has more reactive responses to policy changes in response to disruptive GAI challenges, GitHub’s community has demonstrated a more anticipatory and agile response, leveraging its iterative development practices to reconfigure its governance in real time. Management’s influence in these platforms are limited by the crowds influence, which sets the stage to investigate the capabilities of crowds – more specifically anonymous, unpredictable independents within crowds – and how their temporal perceptions influence trajectory and enforce or disrupt resilience. Using the temporal trajectory model for resilience, which allows us to set clear boundary conditions – limited to this specific temporal lens, we are able to investigate how trajectories are determined in crowd-driven systems.

The evolution of resilience research has laid the groundwork for this inquiry. Early studies in resilience—spanning ecological systems (Folke, 2006), organizational contexts (Almedom, 2013; Ortiz-de-Mandojana & Bansal, 2016) and high-velocity environments (Zaheer et al., 1999)—focused on the capacity of systems to absorb shocks and reorganize without losing core functionality. Subsequent research extended these insights (Boe-Lillegraven et al., 2023; Hillmann & Guenther, 2021), emphasizing the need for adaptive capacity in rapidly evolving contexts. More recently, scholars have drawn attention to the temporal dimensions of resilience. In

this regard, Hernes et al. (2025) introduced the Temporal Trajectory Model (TTM) for resilience—a process-based approach that reconceptualizes resilience as a dynamic interplay between past experiences, present actions, and future possibilities. They suggest that instead of viewing trajectory as linear, “over time” practices – which suggest that time is linear with clear progression (the past is set in the past, the present is now, and the future comes later), a “through time” approach is more appropriate – looking at time as non-linear with instances in time intersecting before, during or after disruptions (the past, present and future trio interacts at the point of the disruption) . In our study, we look deeper into this view with crowds driving the dynamism of temporal decisions – do they consider the past, and do they plan for the future when presented with disruptions?

We propose the following research questions (RQs): RQ1: How do crowds on Stack Overflow and GitHub enact resilience through temporal decision-making, balancing past knowledge, present actions, and future possibilities in response to disruptions? RQ2: How do crowd-governed IS systems and platform affordances shape the temporal practices that enable or hinder resilience in Stack Overflow and GitHub?

To investigate these, we adopt the TTM (Hernes et al., 2025) for resilience, since unlike traditional resilience models, this model dismantles the conventional notion of resilience as a series of discrete phases and instead posits that these phases are interwoven through time. Disruptions are identified as 1) stochastic events – unpredictable and sudden, 2) probabilistic transformations – emerging and probable, or 3) tipping points - unexpected and accelerated. These events’ nature could be changed by the actors’ foresight or vigilance – which is seen in these two case studies. Through the temporal lens that this model provides, we assess how each of the platforms’ crowd manage the disruption, and how the nature of the events, as introduced by Hernes et al. (2025) can change in each case. We also aim to identify which of these platforms’ system affordances allow the crowds to most effectively address disruptions and enforce resilience. The TTM identifies three intersecting phases, which interaction could lead to resilience.

(A) Project - here, actors engage in learning from past experiences and in envisioning possible futures. Actors may have learned from the past at the moment of the disruption, to better manage the present and the future.

(B) Reconstitute - as disruptions occur, actors may apply what was learned during the project phase and set a new trajectory with emergent, real-time adjustments.

(C) Reconfigure- refers to the ability to adjust trajectory, and align with future configurations while considering the past and the present, which will also determine how the actors respond at the disruptive event.

After the immediate disruption has been managed, the focus shifts to institutionalising new mechanisms that incorporate past lessons learned and prepare the system for future shocks. The figure below (Figure 1) shows how disruptions occur throughout time, and when there’s a tipping point, organisations have the capabilities to manage it through the interplay between past, present and future.

This study employs a case study methodology (Yin, 2003) to investigate the crowd’s approach to resilience through temporal trajectory with GAI as disruptive technology in Stack Overflow and GitHub, providing insights into a real-world, contemporary issue. The research unfolds in two phases: Phase 1 involves data col-

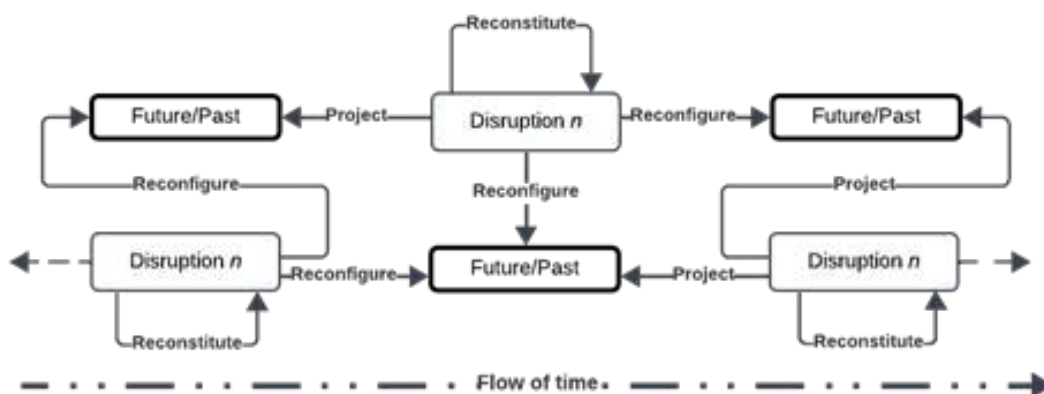


Figure 1: Adaptation of TTM of Resilience (Hernes et al., 2025)

lection – through investigating comment trends, voting patterns, moderation actions etc., case selection, and a literature review; Phase 2 uses Netnography (Kozinets, 2015) through content, trace data, and platform analysis which positions Stack Overflow and GitHub as IS cases disrupted by GAI, with crowd governance and temporal aspects.

Stack Overflow’s governance has long relied on the crowd to assist the reputation-based system—a human-centric framework built on elected moderators and community self-regulation—to ensure content quality on the platform (Jin et al., 2015). This legacy model, despite its successes, created inherent vulnerabilities, especially in light of a human-mimicking technology like GAI. For example, in 2021 a Stack Overflow user foreseen a vulnerability that GAI could exploit, saying “I will admit, it’s more sophisticated than a lot of trolling (maybe even aided by a linguistic AI to compose these questions... that would explain the buzz-words that when put together don’t really mean much)” projecting the GAI disruption, yet such concerns were dismissed by moderators and users with comments like, “If it’s getting serious enough... then we can raise issues up to the Community Team”. These early signals reflected a failure in the project phase: an independent user noticing a possible fault, informing the crowd at the moment of realisation, however this notion is then instantly rejected by the crowd, dismissing any means of preparing for the disruption. The inability to align the crowd to consider such projections are common within the platform, and sets up GAI’s disruption as a tipping point – even though these events could have been well managed in advance.

When GAI usage surged, a tipping point event existed and Stack Overflow’s immediate response was an instant and outright ban on AI-generated content—a reactive measure that epitomised its reconstituting phase. The abrupt ban, imposed without pondering alternative adaptive strategies, led to a governance crisis as moderators became overwhelmed, eventually sparking the moderator strike – where moderators mobilised against the usage of GAI, pausing their actions to govern the platform. The strike itself had an extreme temporal effect on the resilience of the platform, as no enforces allowed for the flooding of low-quality, AI generated content on the platform during this time. In the subsequent reconfiguring phase, the platform upper management attempted to address the crisis through a con-

controversial partnership with OpenAI, without engaging with the crowd. However, rather than establishing a robust, future-oriented framework, this decision was seen by the community as capitulation—effectively “selling out” the platform, with users feeling that their data was being exploited without compensation. This sequence of events which included amongst others users deleting or poisoning their contributions, underscores how an overreliance on legacy systems, a lack of proactive temporal practices, the inability of the crowd to “wait and think”, and the influence of rapid decisions/opinions driven by anonymous users in crowds, can lead to fragmented and ultimately unsustainable resilience outcomes.

GitHub’s strategic anticipation of GAI disruptions is evident in its early development of AI-assisted tools. In June 2021—over a year before ChatGPT became mainstream—GitHub launched Copilot, built on Microsoft’s innovation and early ChatGPT iterations. During its rollout, GitHub used tags like “Product Feedback”, “Shipped”, “Announcement” to engage users in its development, and kept them in the feedback loop to improve the tool in real-time. This proactive initiative, rooted in anticipatory planning and foresight, leveraged historical insights from agile development to prepare its community for the upcoming shift. By investing in beta testing and resource allocation well ahead of the disruption, GitHub established a clear projection phase that informed both its internal strategy and external communications. Cooperation is central to GitHub, with its main selling point being able to work together on coding projects in real time. Projects have an epidemiological timeline, with actions branching out to form temporal “trees” when users work together. Users can work on branches in isolation to fix bugs or experiment on new features without risk, and when approved, the branch can be pulled in, making it a part of the main project. Discussions on new features that could be implemented in GitHub, uses the same logic, allowing the crowd to safely, and inconsequentially propose trajectories – almost frozen in time. The system allows the crowd to ponder over the best approach to the upcoming disruption. They managed it more like probabilistic transformations, which allowed for planned solutions.

When GAI tools entered mainstream usage, GitHub almost didn’t feel its effects, the crowd was aligned, kept in the loop of development, and given enough time to prepare. Instead of being detrimental to their legacy system, they further developed Copilot through the integration of GAI. How the system of GitHub is set up, is to ensure a “through time” approach, it encompasses project, reconstitute and reconfigure phases, as feedback loops remain open through the duration of the epoch. Individuals can voice their opinion without the threat of abrupt decision making, there is a sense of anticipation before the disruption due to the transparency, and crowds are given tools to be proactive. These temporal practices—spanning proactive anticipation, agile recombination, and iterative reconfiguration—explain the platform’s resilience when applying the temporal lens. In contrast to more reactive models, such as Stack Overflow, GitHub’s system is designed around given the crowd “time to think”.

A key challenge in applying the Temporal Trajectory Model to these cases stems from the crowd-based nature of these platforms. Unlike traditional organisations, which operate through hierarchical structures with clear lines of authority, crowd-driven platforms depend on decentralised governance and emergent behaviours.

Phase	Stack Overflow	GitHub
Projection	No structured foresight mechanisms, rapid dismissal of early warnings, absence of phased discussions, lack of pre-emptive adaptation structures.	Feedback loops, branched discussions, phased announcements, structured timelines, beta testing cycles, anticipatory experimentation.
Reconstitution	Abrupt and immediate bans, no transition periods, reactive policy shifts, misaligned enforcement timing, delayed response to emerging issues.	Staggered implementation, iterative adaptation, pre-planned rollout phases, synchronized updates with community input.
Reconfiguration	Sudden governance changes, no structured temporal alignment between platform and crowd, rapid shifts without transition mechanisms.	Continuous refinement cycles, persistent feedback loops, long-term iteration strategies, phased governance adjustments.

Table 1: Mechanisms of time in the trajectory of resilience - Stack Overflow vs. GitHub.

Decision-making is not only distributed but also shaped by the collective agency of independent users, who may align or diverge in their responses to disruption. This creates a fundamental tension between platform governance and community adaptation: while companies like Stack Overflow and GitHub implement top-down policies, the real impact of these decisions depends on bottom-up responses from the user base. Specific temporal practices in crowd-driven contexts are therefore inherently more fluid and unpredictable than in traditional firms, which further introduces complexities of temporality that we plan to address in future research. Complexities such as how much control does the first-responder have in setting a narrative, does the speed of crowd-mobility around an issue change the trajectory, is there a snowball effect in temporality – meaning responses will exponentially become quicker as people react to disruptions – building on ”trending” posts on these platforms, does time zones affect how crowds respond to disruptions, how does prioritizing play a role in trajectory of resilience, and how does the crowd manage that, do crowds take ”breaks” to think and manage disruptions, or is the nature of crowds always reactive -as seen in the ban on GAI and Moderator Strike?

In this research we look at the trajectory itself from a high level – showing how crowds consider the three temporal epochs – being project, reconstitute and reconfigure, however the deeper temporal drive that exists in crowds are multi-layered, and requires vast research. Our future research aims to start this deep-dive into temporal practices in crowds, through mapping interactions, modelling specific components of time, testing existing theories in crowd-driven environments, seeing how control and time interacts in trajectory research, and hopefully discovering more nuances in the research of crowds, time and control in online platforms.

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